

What is claimed is:

- 1 1. A method of determining if a link is alive, comprising:
2 establishing a secure link between a first node and a second node
3 according to a security protocol;
4 sending at least one ping message targeting the second node over the
5 secure link, the at least one ping message defined outside the security protocol; and
6 monitoring for at least one ping reply to determine if the secure link is
7 alive.
- 1 2. The method of claim 1, wherein establishing the secure link comprises
2 establishing a virtual private network session.
- 1 3. The method of claim 1, wherein establishing the secure link comprises
2 establishing a link protected by an Internet Protocol Security protocol.
- 1 4. The method of claim 3, wherein sending the at least one ping message
2 comprises sending at least one Internet Control Message Protocol message.
- 1 5. The method of claim 1, wherein sending the at least one ping message
2 comprises sending at least one Internet Control Message Protocol message.
- 1 6. The method of claim 1, wherein establishing the secure link comprises
2 establishing the secure link between first and second nodes each comprising a security
3 gateway.
- 1 7. The method of claim 6, further comprising sending at least one ping
2 message targeting another node behind the second node.
- 1 8. The method of claim 7, further comprising monitoring for at least one ping
2 reply form the other node.

1 9. The method of claim 1, further comprising tearing down the secure link if
2 the secure link is determined not to be alive.

1 10. The method of claim 9, wherein tearing down the secure link comprises
2 tearing down a security association according to an Internet Protocol Security protocol.

1 11. A method of communicating with a remote node, comprising:
2 establishing a secure link between a first security gateway and a second
3 security gateway, the remote node in communication with the second security gateway;
4 sending at least one ping message to the remote node over the secure link
5 and through the second security gateway; and
6 monitoring for at least one ping reply from the remote node to determine if
7 the secure link is alive.

1 12. The method of claim 11, wherein establishing the secure link comprises
2 establishing a secure link protected according to an Internet Protocol Security protocol.

1 13. The method of claim 11, wherein establishing the secure link comprises
2 establishing a virtual private network session.

1 14. The method of claim 11, wherein establishing the secure link comprises
2 establishing a secure link protected according to a security protocol.

1 15. The method of claim 14, wherein sending the at least one ping message
2 comprises sending at least one ping message defined outside the security protocol.

1 16. The method of claim 15, wherein sending the at least one ping message
2 comprises sending an Internet Control Message Protocol message.

1 17. The method of claim 16, wherein establishing the secure link comprises
2 establishing a secure link protected according to an Internet Protocol Security protocol.

1 18. A system for communicating between a network element and a remote
2 node, comprising:
3 a security module adapted to establish a secure link with the remote node,
4 the secure link having a security mechanism according to a security protocol; and
5 a keep-alive module adapted to send at least one ping message over the
6 secure link to the remote node, the at least one ping message defined outside the security
7 protocol.

1 19. The system of claim 18, wherein the security protocol comprises an
2 Internet Protocol Security protocol.

1 20. The system of claim 18, wherein the at least one ping message comprises
2 an Internet Control Message Protocol message.

1 21. The system of claim 18, further comprising:
2 an interface to a packet-based network, the secure link established over the
3 packet-based network; and
4 a layer to control communications over the packet-based network.

1 22. The system of claim 21, wherein the layer comprises an Internet Protocol
2 layer.

1 23. The system of claim 18, wherein the keep-alive module is adapted to
2 further monitor for at least one ping reply responsive to the at least one ping message to
3 determine if the secure link is alive.

1 24. The system of claim 23, wherein the security module is adapted to tear
2 down a security association of the secure link if the secure link is not alive.

1 25. The system of claim 24, wherein the security association comprises an
2 Internet Protocol Security protocol security association.

1 26. The system of claim 18, wherein the keep-alive module is adapted to
2 further monitor for at least one ping reply responsive to the at least one ping message to
3 determine if the secure link is alive, the system further comprising a module adapted to
4 establish a link over a secondary communication network if the secure link is not alive.

1 27. An article comprising at least one storage medium containing instructions
2 for controlling communications, the instructions when executed causing a controller to:
3 establish a secure link between a first node and a second node according to
4 a security protocol;
5 send at least one ping message targeting the second node over the secure
6 link, the at least one ping message defined outside the security protocol; and
7 monitor for at least one ping reply to determine if the secure link is alive.

1 28. The article of claim 27, wherein the instructions when executed cause the
2 controller to further establish an Internet Protocol security association for the secure link.

1 29. The article of claim 28, wherein the instructions when executed cause the
2 controller to tear down the security association if the controller does not receive the at
3 least one ping reply.

1 30. The article of claim 27, wherein the controller is part of the first node.

1 31. A data signal embodied in a carrier wave and containing instructions for
2 controlling communications, the instructions when executed causing a system to:
3 establish a secure link between a first gateway and a second gateway;
4 send at least one ping message to a remote node over the secure link and
5 through the second security gateway; and
6 monitor for at least one ping reply from the remote node to determine if
7 the secure link is alive.